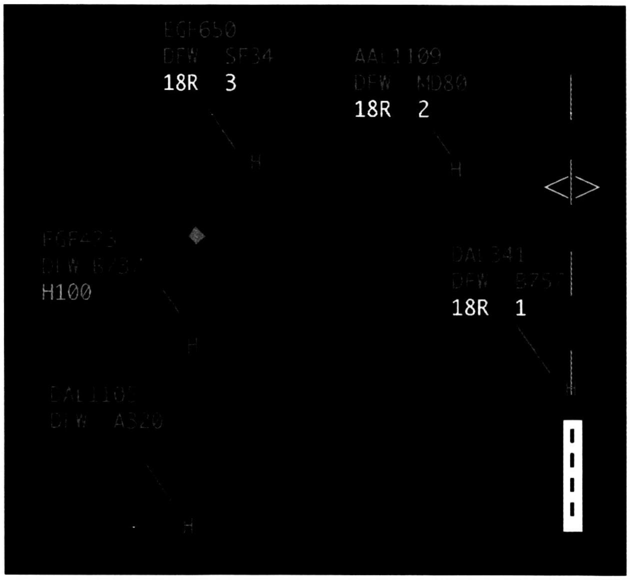

Fig. 1. aFAST graphical-user interface showing typical advisories.

During FY99, a significant amount of the aFAST software infrastructure was completed. The new design addresses several key limitations discovered during the operational testing and deployment of pFAST, and allows easier rapid prototyping of sequencing and conflict resolution logic. In addition, a method for investigating CHI requirements of the aFAST GUI, independent of the aFAST scheduling algorithms, was developed. This approach provided controllers with active advisory information replayed from recorded traffic scenarios. Though the controllers are not actively controlling the aircraft, they issue the advisories and evaluate the user interface. This method decouples the evaluations of the user interface and scheduling algorithms, while maintaining a realistic air traffic environment. A series of "shadow" simulations was conducted to evaluate advisory format, symbols, timing, and use of color. During these simulations, controller reaction times to advisory onset and command issuance were recorded. Following each scenario, questionnaires were administered to assess the usability of and workload associated with aFAST advisories. Results from the study comparing color and monochrome advisory presentation indicate that controllers noticed advisory onset more quickly when those advisories were presented in color. Controllers also rated the color advisories as producing less screen clutter and lower mental workload.

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Distributed Air/Ground Traffic Management

Karl Bilimoria, Steve Green

Distributed Air/Ground Traffic Management (DAG-TM) is an integrated gate-to-gate operational concept in which flight deck crews, air traffic service providers, and aeronautical operational control (AOC) personnel use distributed decision-making to enable user preferences and increase system capacity, while meeting air traffic management requirements (figure 1). The DAG-TM operational concept was developed by NASA (Ames, Langley and Glenn Research Centers) under the Advanced Air Transportation Technologies (AATT) Project, as a detailed instantiation of possible operational modes for Free Flight. It embodies the far-term vision of the AATT Project regarding air traffic operations in the National Airspace System (NAS).

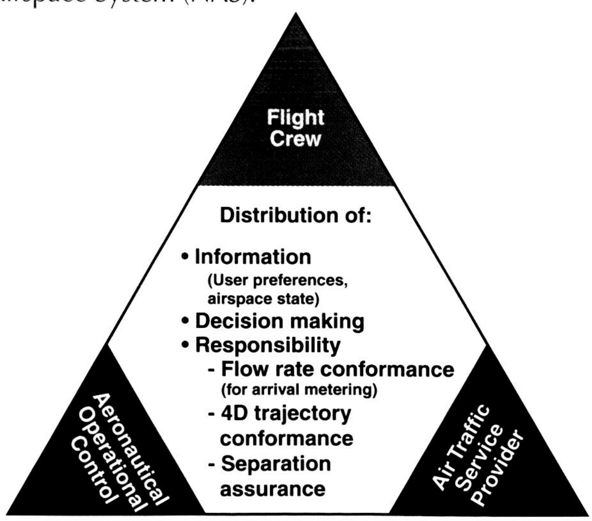

Fig. 1. The DAG-TM triad.

DAG-TM operations will be accomplished with a human-centered operational paradigm enabled by procedural and technological innovations. All user classes (commercial carriers, general aviation, etc.) will be addressed by DAG-TM, with emphasis directed toward ensuring access to airspace resources for the entire user community. Although all users would benefit from DAG-TM, users with higher levels of equipage would benefit even more. Figure 2 depicts some of the airspace problems that arise from dynamic constraints in the NAS; the DAG-TM solutions to these (and other) problems are called concept elements. The DAG-TM operational concept was formulated as a cohesive set of 15 concept elements designed to safely mitigate the extent and effect of dynamic NAS constraints, while maximizing the flexibility of airspace operations. From these 15 concept elements, 4 were selected for initial studies under the AATT Project. They are (1) En Route Airspace: Collaboration for mitigating local Traffic Flow Management (TFM) constraints; (2) En Route Airspace: Free maneuvering for user-preferred separation and local TFM conformance; (3) En Route Airspace: Trajectory negotiation for user-preferred separation and local TFM conformance; and (4) Terminal Airspace: Self-spacing for merging and in-trail separation of arrivals.

It is noted that Free Maneuvering and Trajectory Negotiation are complementary concept elements that address the problem of inefficient trajectory deviations for separation and local TFM conformance.

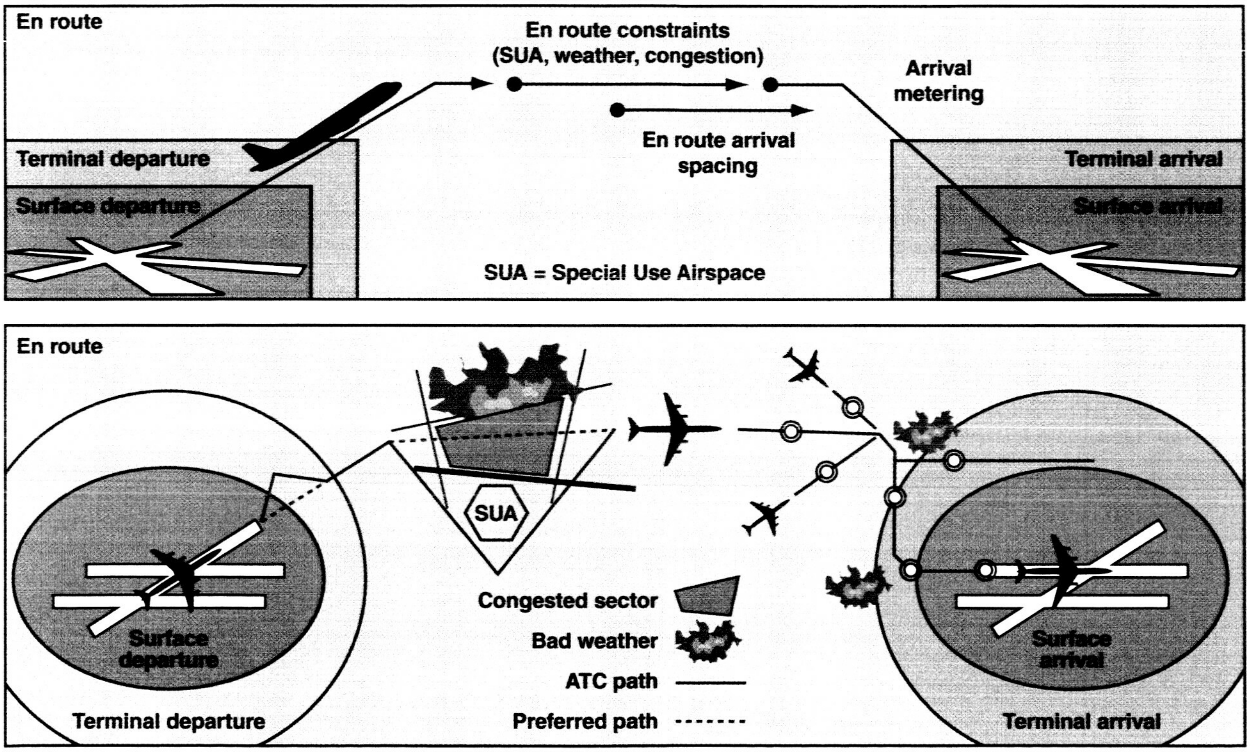

Fig. 2. Examples of airspace problems addressed by Distributed Air-Ground Traffic Management (DAG-TM).

Ongoing research activities under each concept element include concept development, research prototype development, concept validation, cost/benefits assessments, and safety assessments.

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Information Management for Airline Operations

Roxana Wales, John O'Neill

Ames researchers are investigating airline delays in a collaborative project with United Airlines (UAL). The research team is conducting a systemic study of airline operations and delay situations in United's operations at San Francisco airport in order to identify potential sources of up-to-the-minute, real-time delay information and ways to feed that information, electronically, into the Ames-developed Surface Management System (SMS) technology. Such information will improve traffic movement on the ramp (non-taxiway) area of the airport and increase the overall efficiency of the air traffic system. By collaborating in the project and opening their operations to Ames' researchers, United is benefiting from an increased understanding of their own delay situations, their work-practice procedures, and the ways that information technology and communications systems can be used to better manage their operations and to reduce delays and their effects.

The initial study has focused on United's Shuttle operations. Through a process of intensive fieldwork that includes observations, interviews, and the writing and analysis of field notes, the researchers have identified areas of work procedures that have been analyzed for communication, computer support, and knowledge-management requirements, and for the ways in which these areas organizationally either contribute to or help manage delay situations. Four areas were studied in 1999: (1) the ramp area of the airport where planes are parked at the gate and where baggage and cargo are loaded and unloaded (see figure 1); (2) the bag room; (3) the station operations center or local control center for operations; and (4) customer service operations.

Additionally, in 1999 the team visited United's operations, data analysis, and scheduling centers at UAL's world headquarters in Chicago to study the larger system environment of UAL and the effect that this environment has on local San Francisco operations.

Preliminary study findings have identified the complex nature of airline delays, problems in teaming structures and the lack of training in procedures, and "disconnects" in information flows across UAL. The study has helped to define a new information environment—one that facilitates information flows and provides the information required for the next generation of decision-making tools at UAL, and one that can also provide delay information to an SMS technology.

Fig. 1. Ramp operations.

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